Telemedicine in Healthcare Delivery: Knowledge, Attitude, and Skill Set of Medical Students in Selected Universities in Africa

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Research Article

Abstract

Background :Telemedicine is a rapidly expanding technology used in healthcare settings, especially since the emergence of COVID-19. For this intervention to be implemented successfully, important skills are required from health professionals. Hence, this study seeks to determine the preparedness of African medical students for the use of telemedicine in healthcare delivery by assessing their knowledge, attitude, and skill set ,

Methods: This was a descriptive cross-sectional study. Data were collected online through a 33-item pre-tested, self-administered questionnaire from three selected medical schools in Africa. Data were analysed using descriptive and analytical statistics with a significant level of 0.05. Data analysis was done on SPSS version 20,

Results : Only 559 respondents were eligible for the study. 338 (60.5%) were male and the most prevalent age range was 21-23 years (276, 49.4%). 346 (61.9%) had good knowledge while 461 (82.5%) expressed a good attitude toward telemedicine. Only 144 (25.8%) had a good skill set in using telemedicine. 513 (91.6%) respondents agreed and strongly agreed that the use of telemedicine should be included in medical training. There was a statistically significant association between the skill set of respondents and schools (p=0.001) and gender (p<0.001),

Conclusions: The respondents have a good attitude but average knowledge and poor skill set of telemedicine usage in healthcare delivery. However, the majority are interested in learning about telemedicine in medical training. This study shows the need to incorporate telemedicine within the curricula of African medical schools.

Introduction

The development of certain applications to improve the quality of healthcare and physical doctor-patient consultation is currently an area of focus, particularly since the emergence of the COVID-19 pandemic.[1] Adopting telemedicine has been demonstrated to be a solid solution to the challenges in healthcare delivery and may also reduce the cost of care for individuals with health issues diagnosed as long-term illnesses.[2]

Telemedicine is a rapidly expanding technology used in healthcare settings where medically related information is shared via information and communication technology (ICT).[3] It entails providing healthcare, education, and research as well as promoting health and preventing disease while avoiding distance-induced barriers.[4] The use of telemedicine in healthcare delivery has been effective in disseminating medical information from experts to distant remote areas.[5-7] Currently, several African nations are embracing the use of telemedicine to address problems in healthcare settings.[5] For telemedicine interventions to be implemented successfully, acceptance, knowledge, and skills of telemedicine are required from health professionals.

The willingness to adapt and change the attitude of healthcare practitioners toward telemedicine interventions is through proper knowledge of the benefits and capabilities of telemedicine.[8,9] Studies conducted previously revealed that the lack of willingness to use telemedicine is due to attitudes to the patient-doctor relationship and their level of anxiety about technology.[10] Studies have been conducted to assess the knowledge, attitude, and skillsets of medical students and healthcare professionals in different countries.[5,11–13] However, no study has been carried out to evaluate these variables among medical students in African countries.

Hence, this study seeks to determine the preparedness of African medical students for the use of telemedicine in healthcare delivery by assessing their knowledge, attitude, and skill set.

Methodology

Study Design and Setting

A descriptive cross-sectional study was conducted among medical students in three medical schools from different African regions to determine the knowledge, attitude, and skill set of telemedicine among medical students in Africa. The study area was selected based on the feasibility of data collection through the Liaison Officers of the Federation of African Medical Student's Association Standing Committee on Medical Education and Research (FAMSA-SCOMER) in the medical schools. The selected schools were; the University of Ibadan (Nigeria), the University of Bamenda (Cameroon), and the Catholic University of Health and Allied Sciences (Tanzania).

Sample size

The sample size for this study was determined using the Leslie-Kish formula with a 95% confidence interval and a proportion (P) of telemedicine knowledge and attitude of 59%. This was the level of good knowledge of telemedicine in a similar study conducted among medical students in Pakistan.[12] The tolerance error of 0.05 was selected and a contingency of 10%. Accordingly, the total sample size was estimated to be 409.

$$N = Z^2Pq/e^2$$

Z = z-score (at 95% confidence interval) = 1.96; q = 1-P; e = tolerance error, 0.05

$$n = \frac{1.96^2 \times 0.59 \times (1-0.59)}{0.05^2} = 372$$

with 10% contingency

$$n = 372 + 37 = 409$$

Therefore, a minimum of 409 participants across the selected medical schools were recruited for this study.

Study instrument

The study questionnaire used was designed and validated by authors of a similar study conducted among health professionals in India but modified mainly the sociodemographic characteristics and choice of words to suit the study population.[13] Permission for reproducibility was obtained from the authors. (Supplementary Material 1)

The questionnaire was in the form of Google Forms and included a total of 54 questions and 5 sections. Section A included the sociodemographic characteristics and awareness of telemedicine (9 items), section B included knowledge of telemedicine in healthcare delivery (10 items), section C included the attitude to telemedicine (11 items), Section D included the skill set (13 items) (see supplementary materials section for detail).

Data Collection

Data were collected using a self-administered structured online questionnaire written in English and French languages, which are the most spoken languages in the selected medical schools. Participants were recruited using a convenience sampling method. This sampling method was adopted due to lack of access to a database of medical students from selected schools and the peculiarity of medical training where students are often at different locations for clinical rotations. All undergraduate students were contacted through the Liaison Officers of their Medical Students' Associations (MSAs). Broadcast messages promoting the study were also shared on WhatsApp, Telegram, and Email. The questionnaire included questions about whether the respondent is a medical student and attends any of the medical schools eligible for the study. Responses from medical students from other medical schools were excluded and also from students from eligible schools but studying different courses.

The pilot study was from 19th May to 21st May 2022. The data were collected over a period of two months, from the 25th of May to the 23rd of July 2022.

Analysis

Respondents' level of knowledge of telemedicine was assessed by questions which were answered as either 'Yes' or 'No.' A correctly answered question was scored '1' while a wrongly answered question was scored '0.' A minimum of 0 and a maximum of 10 points were attainable for section B. The attitude of respondents towards telemedicine in healthcare delivery was assessed through questions that required graded responses on a five-point Likert scale ranging from 0–4 ('0' for strongly disagree; '1' for disagree; '2' for undecided; '3' for agree; and '4' for strongly agree). A minimum score of 0 and a maximum score of 44 points were attainable for section C. While the skillset in using telemedicine was assessed through questions that required graded responses on a four-point scale ranging from 0–3 ('0' for unskilled; '1' for the learner; '2' for intermediate; and '3' for an expert). A minimum score of 0 and a maximum score of 39 points were attainable for section D.

The raw scores and percentages for each of the sections for awareness, knowledge, attitude, and skill were calculated for each respondent. The mean, range, and standard deviation for each section were also calculated. For this study, scores less than or equal to 49% were considered poor, scores between 50–69% were considered average or moderate, while scores equal to or above 70% were considered good or high concerning the knowledge, attitude, and skill of telemedicine.

Data were imported to Microsoft Office Excel 2016 from the Google Forms, checked, cleaned, and edited before being exported to SPSS version 20 for analysis. The descriptive statistics were carried out on each section. A chi-squared test was used to assess the relationship between sociodemographic factors (sex, university, and year of study) and knowledge, attitude, and skill level. It was also used to test for association between the level of skills and knowledge or attitude toward telemedicine. An independent sample t-test was also used to test for association between mean scores of knowledge, attitude and skill level, and gender while one-way ANOVA was used for the association between universities and mean scores of knowledge, attitude, and skillset. A statistical significance level of 0.05 was used in the analysis.

Ethical Consideration

The ethical clearance to conduct this study was obtained from the University of Ibadan/University College Hospital (UI/UCH) Ethics Committee with the assigned number UI/EC/22/0155, and all methods are performed in accordance with relevant guidelines and regulations, Also, the online form contained the objective of the study, and a question seeking informed consent was also added. Only the responses of respondents who agreed to the informed consent were included.

Results

DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

A total of 621 responses were received, however, only 559 were included in this study. The participants included students from three different medical schools in Africa, with University of Ibadan (UI), Nigeria, having the highest number of participants (247, 44.2%). There were 197 (35.2%) and 115 (20.6%) participants from Catholic University of Health and Allied Sciences (CUHAST)in Tanzania and University of Bamenda in Cameroon, respectively. The majority of the respondents (338, 60.5%) were male and the most prevalent age range (276, 49.4%) was 21-23 years (mean age = 21.7±0.105; median = 21; range = 18). The highest numbers of participants were second-year medical students (179, 32.0%) (Table 1 for details).

The majority of respondents (451, 80.7%) had an intermediate and advanced level of knowledge of the internet and computers. Only 28 (5%) of respondents had formal training on telemedicine, however, most respondents (541, 96.8%) expressed willingness to attend training to develop their knowledge, understanding, and application of telemedicine.

KNOWLEDGE, ATTITUDE, AND SKILLS

It was observed from the study that 346 (61.9%) respondents had good knowledge of telemedicine of which 211 (61.0%) were males, 181 (52.3%) were between the age of 21-23 years and 107 (30.9%) were in their second year (Table 2) (Table 3). Medical students from UI made up the majority of the respondents with good knowledge (157; 45%), followed by students from CUHAST with 120 respondents (34.7%) and Bamenda with 69 respondents (22.2%) (Figure 1). There was no significant difference in the level of knowledge among the schools (p=.871) (Table 3). All students with poor understanding have not had any formal training in telemedicine before the study, while 61.5% of those with good knowledge had intermediate level of proficiency with computers and the internet.

Out of a total of 559 medical students, 461 (82.5%) expressed a good attitude toward telemedicine (figure 2). 513 (91.6%) respondents agreed and strongly agreed that the use of telemedicine should be included in medical training and 523 (73.4%) agreed and strongly agreed to attend training courses if offered at their medical school. Table 3 summarizes the sociodemographic characteristics of medical students' attitudes toward telemedicine. Attitude towards telemedicine did not significantly differ between the schools (p=.0.098) or gender (p=.355). (Table 3)

The findings indicated that 144 (25.8%) medical students had good skills in using telemedicine. 519 (92.1%) were skilled in the use of email with file attachments and 439 (78.4%) were skilled in videoconferencing. However, only 85 (15.2%) were experts in using medical software for images. The majority of students (82, 56.9%) with strong skill sets attended UI, then CUHAST (44, 30.6%) and Bamenda (18, 12.5%) (Figure 3). We observed a significant relationship between the level of skillset among the schools (p=.001) and genders (p<.001) as shown in Table 3.

Discussion Of Results

The need for telemedicine and its importance has become clear more than ever during these testing times of COVID-19 pandemic.[12] The present study reveals that about 62% and 82.5% of the respondents had good knowledge and attitude toward telemedicine respectively. These findings are in line with studies conducted by Kazmi et al. and Ahmed et al where it was reported that younger healthcare providers are in good knowledge and attitude toward positive aspects of this useful technology.[12,14] However, only one-fourth of our respondents possess good skillsets in the use of telemedicine. This corresponds with the result of similar research where about half of health professionals lacked adequate skills in telemedicine.[13] Also, about 95% of respondents had not attended formal telemedicine training. In the study done by Yaghobian et al., it was reported that telemedicine practice by French medical students and residents was limited. This shows the lack of telemedicine training in medical training in Africa and even the European countries.[11]

However, positive observations were recorded when 92% of our respondents supported the idea that telemedicine should be incorporated into their medical training and 93.6% believed that they would attend training courses in telemedicine if they were offered at their medical schools. Similar trends were reported in other studies.[11,15] On the other hand, Kong et al. reported in their study that the majority of US medical students appeared to be undecided in their interest in telemedicine.[16] A study conducted at a German medical university in 2017 reported that the introduction of telemedicine education and training sessions helped students enhance their knowledge, skills, and attitudes towards telemedicine.[16]

The results of this study reveal that female medical students have statistically significant lower skill and attitude scores compared to male students and a lower knowledge score which is statistically non-significant. These results are consistent with similar studies which demonstrated that a higher knowledge score of telemedicine was observed among male medical students and health professionals compared to females.[5,12,13] Kazmi et al. failed to observe a significant association between medical students' gender and attitude scores toward telemedicine.[12] This finding suggests a potential gender disparity in the access to knowledge about Information Communication Technologies (ICTs) and the need to bridge the gender gap in telemedicine among medical students.

There was a statistically significant relationship between the medical school and skillset of respondents with medical students from the University of Ibadan more likely to have a higher level of skill set compared to CUHAST and followed by the University of Bamenda. This aligns with the trend of digital penetration in these three countries.[17] There was no statistically significant relationship between the year of the study and the level of knowledge, attitude, and skillset. Besides, our finding suggests a higher level of knowledge among medical students in pre-clinical years compared to those in clinical years. This may be due to the low response rate from clinical students. However, this finding contradicts a similar study conducted among medical students in Pakistan.[12] Yaghobian et al. also observed an increasing trend toward telemedicine practice and knowledge in several French medical schools by the academic year.[11] Another explanation for this is the recent increasing interest in technology and ICTs among younger generations in African countries and globally.

Despite the good knowledge and attitude toward telemedicine among respondents, 72.6% of the respondents believed that the management of patients including surgical procedures cannot be done through telemedicine. This may be because telemedicine is not yet incorporated into medical training in these schools. Kazmi et al. noted that the majority of their respondents opined that consultation via telemedicine has a high chance of medical errors.[12] On the contrary, recent studies have reported that telemedicine's diagnostic accuracy is nearly as good as traditional face-to-face practice.[18,19]

Limitations and conclusion

Firstly, due to the lack of data from all the major regions of Africa, the results of this study cannot be generalized across the entire African medical student population. In addition, access to social media platforms and inadequate internet infrastructure may have influenced the result. Besides the data collection was entirely online and the identity of the respondents could not be confirmed. Moreover, the organizational factors, beliefs of administrative decision-makers, and the cost-effectiveness of the integration of telemedicine education and training modules into African medical schools' curricula were not considered. Nevertheless, our study included a large sample size and a remarkable response rate.

In conclusion, students from selected medical schools in Africa have average knowledge and a good attitude toward the sage of telemedicine in healthcare delivery and willingness to participate in training on ICT and telemedicine. This study shows the need for the incorporation of telemedicine in medical students training in African medical schools. This is the first international-scale study on telemedicine to be carried out among medical students in African countries. Further studies should consider the organizational factors and the cost-effectiveness of incorporating telemedicine in medical training and healthcare delivery.

Declarations

Authors Contributions

AOB conceptualised the research; AOB, ATR and PA designed the study; IKP, DAO, BSD collected data; AOB and AAA analysed data and data visualisation; ATR, IKP and AO drafted the introduction, PA, and EAA wrote methodology, FOB drafted the result, DAO and BSD drafted the discussion and conclusion; EOU and UOA drafted final manuscript; OSO supervised research and reviewed the manuscript critically; all authors approved the manuscript for submission.

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Conflict of Interest

Authors Declare no conflict of interest

Declarations :

Ethical approval :

The ethical clearance to conduct this study was obtained from the University of Ibadan/University College Hospital (UI/UCH) Ethics Committee with the assigned number UI/EC/22/0155, and all methods are performed in accordance with relevant guidelines and regulations, Also, the online form contained the objective of the study, and a question seeking informed consent was also added. Only the responses of respondents who agreed to the informed consent were included.

Concent for publication :

All authors agreed to publish the research in its current form.

Availability of data :

The datasets used and analysed during the current study are available from the corresonding author on a reasonable request.

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Tables

Table 1: Sociodemographic Data of 599 respondents from the University of Ibadan (Nigeria), University of Bamenda (Cameroon), and the Catholic University of Health and Allied Sciences (Tanzania) 2022.

Demographic	Freq n (559)	Percentage %
Age Range		
<18	7	1.3
18-20	170	30.4
21-23	276	49.4
>= 24	106	19.0
Gender		
Male	338	60.5
Female	221	39.5
Medical School		
Catholic University of Health and Allied Sciences	197	35.2
University of Ibadan	247	44.2
University of Bamenda	115	20.6
Year of Study		
1st year	158	28.3
2nd year	179	32.0
3rd year	109	19.5
4th year	34	6.1
5th year	31	5.5
6th year	38	6.8
7th year	10	1.8
Knowledge of computers and the internet		
Beginner	108	19.3
Intermediate	379	67.8
Advanced learner	72	12.9
Heard of the term 'Telemedicine' prior to study		
No	216	38.6
Yes	343	61.4
Attend formal training in Telemedicine		
No	531	95.0

Yes		28	5.0
Aware of Telemedicine Unit in college			
No		113	20.2
Yes		68	12.2
I don't know		378	378
Willingness to attend Telemedicine training			
No		18	3.2
Yes		541	96.8

Table 2: Knowledge score, attitude score, and skill score of respondents

	Poor, n(%) 0-49	Average, n(%) 50-69	Good, n(%) 70-100
Knowledge	78 (14.0)	135(24.2)	346(61.9)
Attitude	6(1.1)	92(16.5)	461(82.5)
Skill Set	265(47.4)	150(26.8)	144(25.8)

Table 3: Relationship between sociodemographic characteristics and good knowledge, good attitude, and good skills of telemedicine use

Sociodemographic characteristics	Knowledge Freq (%)	P value	Attitude Freq (%)	P value	Skill set Freq (%)	P value
Medical school		0.871		0.098		0.001
UI	157 (45.4)	X^2= 1.243	202 (43.8)	X^2=7.829	82 (56.9)	X^2=19.748
CUHAST	120 (34.7)		168 (36.4)		44 (30.6)	
Bamenda	69 (19.9)		91 (19.7)		18 (12.5)	
Gender		0.940		0.355		<0.001
Male	211 (61.0)	X^2= 0.124	285 (61.8)	X^2=2.070	104 (72.2)	X^2=16.914
Female	135 (39.0)		176 (38.2)		40 (27.8)	
Age range		0.025		0.152		0.889
<18	3 (0.9)	X^2=14.454	5 (1.1)	X^2=9.404	2 (1.4)	X^2=2.309
18-20	99 (28.6)		130 (28.2)		37 (25.7)	
21-23	181 (52.3)		234 (50.8)		76 (52.8)	
>=24	63 (18.2)		92 (20.0)		29 (20.1)	
Year of Study		0.412		0.944		0.190
1st year	100 (28.9)	X^2=12.423	125 (27.1)	X^2=5.374	32 (22.2)	X^2=16.016
2nd year	107 (30.9)		146 (31.7)		39 (27.1)	
3rd year	66 (19.1)		92 (20.0)		33 (22.9)	
4th year	20 (5.8)		31 (6.7)		15 (10.4)	
5th year	21 (6.1)		27 (5.9)		11 (7.6)	
6th year	23 (6.6)		32 (6.9)		11 (7.6)	

7th year	9 (2.6)		8 (1.7)		3 (2.1)	
Knowledge of computers and the internet		0.015 $X^2=12.408$		0.837 $X^2=1.440$		<0.001 $X^2=162.851$
Beginner	58 (16.8)		87 (18.9)		2 (1.4)	
Intermediate	240 (69.4)		314 (68.1)		89 (61.8)	
Advanced	48 (13.9)		60 (13.0)		53 (36.8)	
Heard of term 'Telemedicine' prior to study		<0.001 $X^2=58.805$		0.298 $X^2=2.419$		<0.001 $X^2=25.969$
Yes	238 (68.8)		287 (62.3%)		109 (75.7)	
No	108 (31.2)		174 (37.7)		35 (24.3)	
Attend formal training in Telemedicine		0.063 $X^2=5.528$		0.803 $X^2=0.439$		0.363 $X^2=2.025$
Yes	22 (6.4)		24 (5.2)		10 (6.9)	
No	324 (93.6)		437 (94.8)		134 (93.1)	
Aware of Telemedicine Unit in college		0.002 $X^2=17.023$		0.072 $X^2=8.612$		0.244 $X^2=5.451$
Yes	52 (15.0)		64 (13.9)		24 (16.7)	
No	76 (22-0)		94 (20.4)		30 (20.8)	
I don't know	218 (63.0)		65.7 (303)		90 (62.5)	
Willingness to attend Telemedicine training		0.035 $X^2=6.698$		0.005 $X^2=10.801$		0.940 $X^2=0.123$
Yes	339 (98.0)		451 (97.8)		140 (97.2)	
No	7 (2.0)		10 (2.2)		4 (2.8)	

Figures
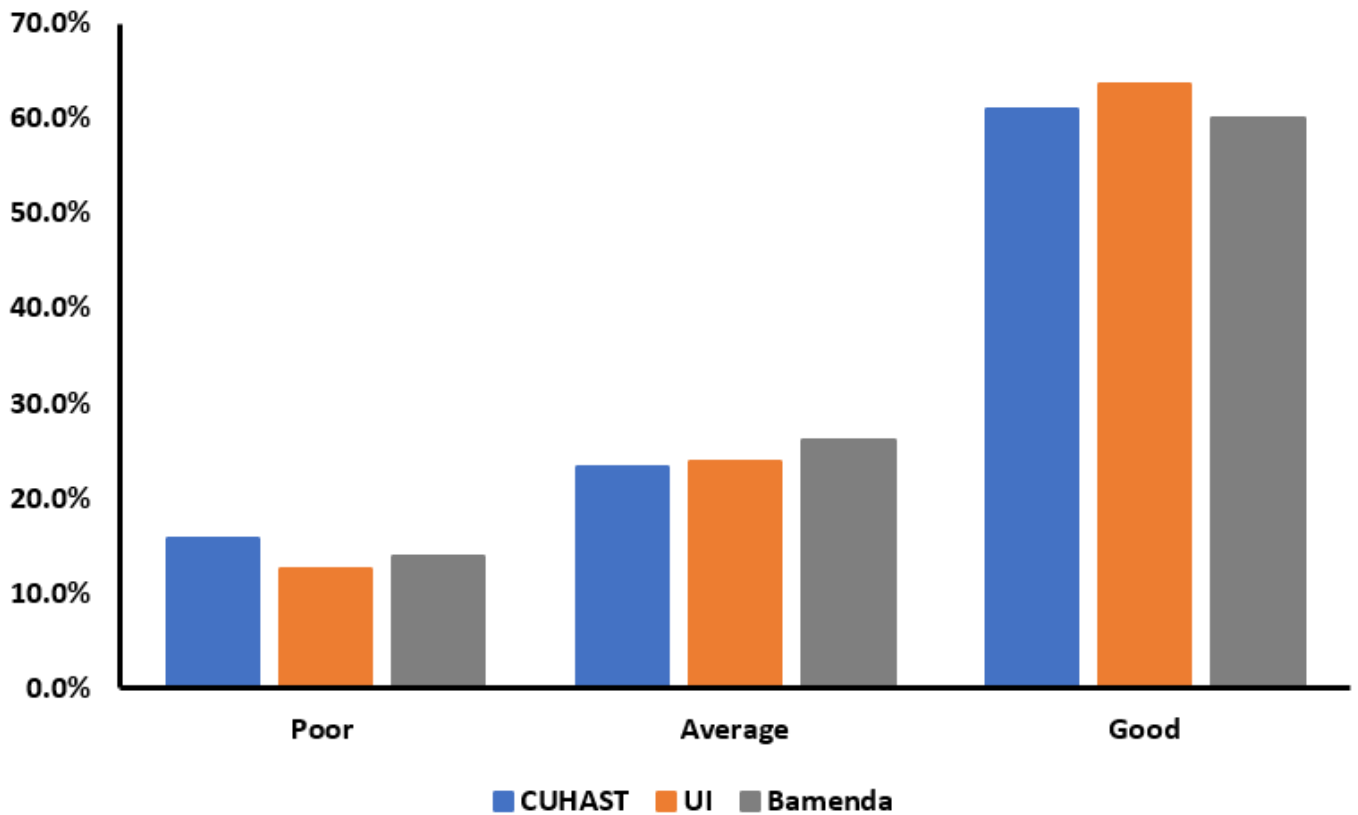
Level of Knowledge of Medical Students

Figure 1

Knowledge of telemedicine among respondents in different schools

shows the knowledge of Telemedicine among the selected countries on a vertical grouped bar chat of poor, average and good, based on the analysized sociomographic data of respondents.
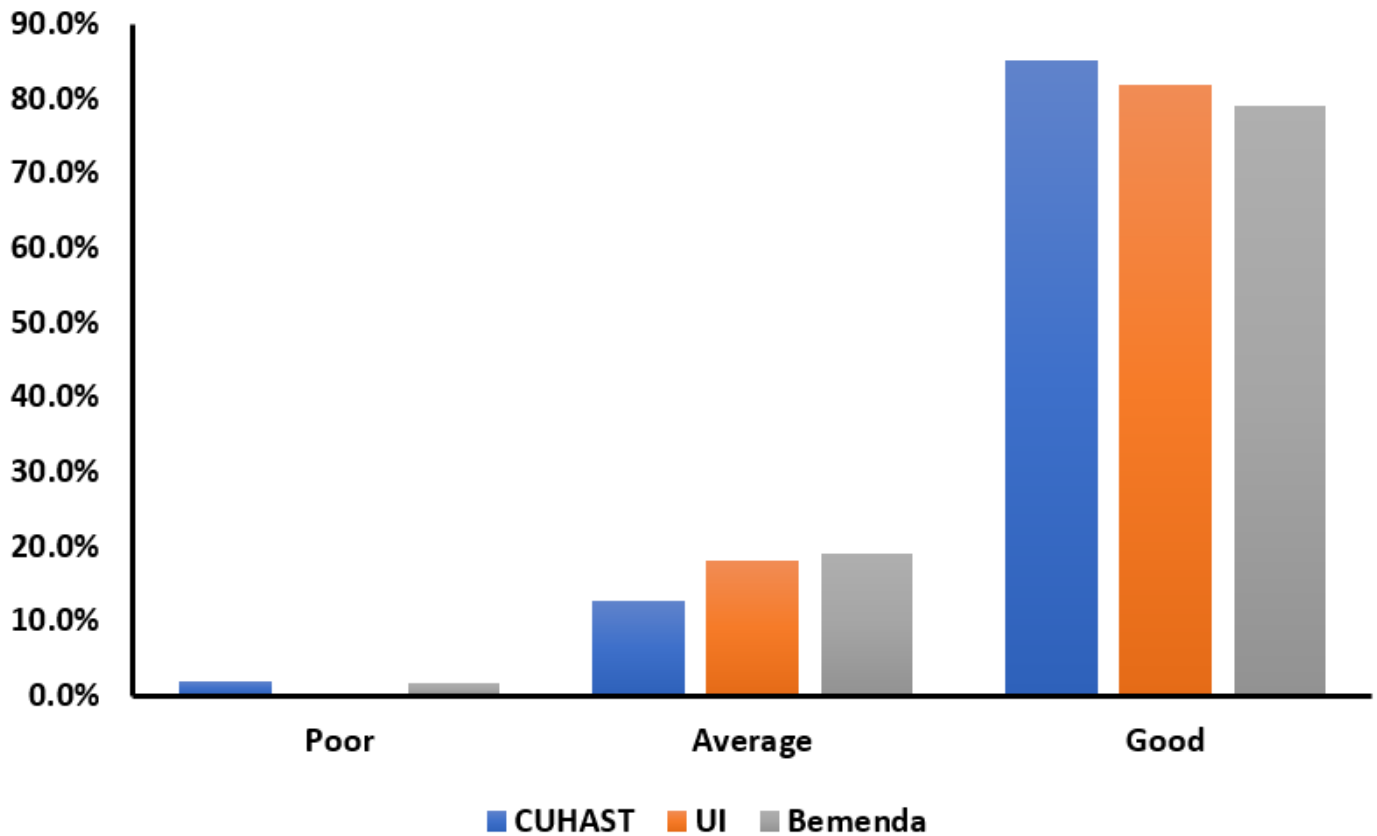
Figure 2

Attitude towards telemedicine among respondents in different schools

shows the Attitude towards telemedicine among respondents in different schools on a vertical grouped bar chat of poor, average and good, based on the analysized sociodemographic data of respondents.
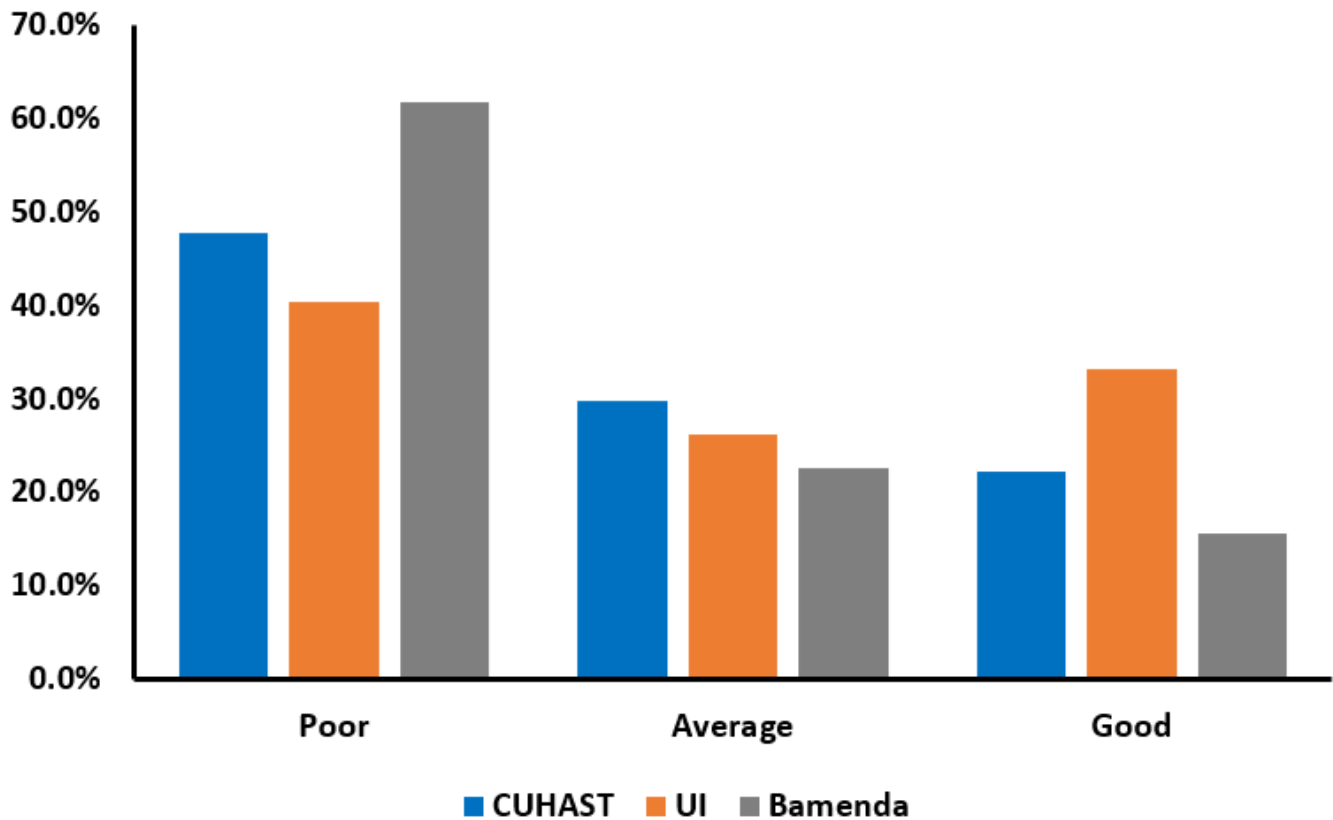
Figure 3

Skill of telemedicine use among respondents in different schools

showsSkill of telemedicine use among respondents in different schools on a vertical grouped bar chat of poor, average and good, based on the analysized sociodemographic data of respondents.

Supplementary Files

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- supplementarydata.docx